INVESTIGATING THE ROLE OF TURN INDICATOR USAGE BY EXITING VEHICLES IN GAP ACCEPTANCE AT SINGLE-LANE ROUNDABOUTS

Road sign for a roundabout in Germany and Sweden (right-hand traffic).

Traffic sign to identify a roundabout in the UK (left-hand traffic).

Road sign for a roundabout in the U.S. (right-hand traffic).

Give way sign at a roundabout in Australia (left-hand traffic).

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**round·a·bout**  
[n. round-uh-bout]

A subset of circular intersection that is **yield-controlled** with **channelized approaches** and geometric curvature such that **travel speeds are less than 30 mph** *(Roundabouts: An Informational Guide – Second Edition)*
INTRODUCTION

ROUNDABOUTS vs. CONVENTIONAL INTERSECTIONS

28% REDUCTION IN FUEL CONSUMPTION

29% REDUCTION IN CO EMISSIONS

40% FEWER COLLISIONS


ROUNDABOUTS vs. CONVENTIONAL INTERSECTIONS

- Diverging
- Merging
- Crossing
priority

WHO STOPS WHEN THEY SHOULDN’T?  WHO GOES WHEN THEY SHOULDN’T?

WHICH TRAFFIC STREAM ARE THEY IN?

absolute priority mode

vs.

limited priority mode
PRIORITY-SURRENDERING (PS)

When a circulating vehicle gives up their right-of-way (by either stopping or slowing significantly) and allows unwarranted entry of a vehicle that was waiting on the approach.
When a driver on a roundabout approach enters into a gap in the circulating stream of traffic that is of insufficient size and the circulating vehicle must apply the brakes in order to avoid collision.
PRIORITY-ABSTAINING (PA)

When an entering vehicle abstains from taking right-of-way by stopping or slowing significantly for an exiting vehicle or when there are no other vehicles in the roundabout.
gap is always too small

accepted gaps

rejected gaps

gap is acceptable
ROUNDABOUT CAPACITY

\[ C = 1130 \cdot e^{-0.0010 \cdot v_c} \]

\[ q_{e,\text{max}} = A \cdot e^{-B \cdot q_c} \]

(local calibration)

\[ A = \frac{3600}{t_f} \quad B = \frac{(t_c-t_f/2)}{3600} \]
Illustration of the location of the diverge point (a) and the effect of exiting vehicles on headway measurements (b).
Headway distribution characteristics for Middlebury, VT
Headway distribution characteristics for Fairbanks, AK
Rejected headway distribution characteristics for Middlebury, VT and Fairbanks, AK
$P(x)$

Gap (sec)

1.0

0

$t_c$

gap is always too small

gap is acceptable

rejected gaps

accepted gaps
Priority abstaining behavior influenced by lack of indicator use consistent across study sites, drivers rely on visual cues

Capacity of roundabouts diminished by non-compliant behavior Critical gaps are being artificially inflated

\[ q_e = f(h) \] Dynamic headways counter current simplified assumption Implications for capacity estimation
**Research Contributions**

- advances the understanding of roundabout operations using real-world driver behavior
- indicates the need to modify capacity estimation methodologies to include exiting vehicles
- prompts consideration of consistent state and federal guidance on the use and enforcement of turn indicators

**Future Research**

Expand study region, increase sample size, further incorporation of accepted headways
Thank you!

QUESTIONS and/or COMMENTS